Chapter 10. Laser Safety.

As stated in Chapter 2, any Command whose personnel are occupationally exposed to class IIIb or class IV lasers shall have a Laser Safety Officer (LSO). The LSO shall ensure that personnel exposure to laser radiation is kept within guidelines listed in ANSI Z136.1 and ANSI Z136.3, and that work with lasers is accomplished in accordance with OSHA regulations as stated in 29 CFR 1926.54, and USACE guidance in EM 385-1-1. This shall be accomplished by establishing and ensuring compliance with a Laser Protection Program.

10-1. Classifications of lasers.

a. Lasers are classified by their hazard capabilities. The ANSI Z136.1 standard accurately defines the classifications of lasers depending on the power output and light wavelength, but in general the classifications are as follows:

(1) Class I - Cannot produce hazardous radiation. These devices may contain an embedded class IIIb or class IV laser.

(2) Class II - Continuous intrabeam exposure may damage the eye. Momentary intrabeam exposure (<0.25 second) is not damaging to the eye.

(3) Class III - Can damage the eye during momentary intrabeam exposure.

(a) - Class IIIA: intermediate power lasers (1-5 mW). Only hazardous for intrabeam viewing.

(b) - Class IIIB: moderate power lasers (5-500 mW). In general Class IIIB lasers will not be a fire hazard, nor are they generally capable of producing a hazardous diffuse reflection.

(4) Class IV - May damage the skin as well as the eye during momentary intrabeam exposure or exposure to diffuse reflection. These lasers may be fire hazards and may produce laser generated air contaminants(ozone) and plasma radiation.

10-2 Safety Features and Labeling Requirements.

The Department of Health and Human Services in 21 CFR 1000-1050, the ANSI standards, and USACE EM 385-1-1 require that certain engineered safety features and labeling be used with the different classes of lasers. Table 10-1 cross-references the safety features and label requirements for each class of lasers. Examples of laser labels and area postings are included in Appendix F.

Lasers may have additional safety features or labeling requirements. Check the manufacturer's manual for additional labeling requirements.

TABLE 10-1
Laser Safety Features and Labeling Requirements

Safety Feature	Class			
Safety Features	I	II	III	IV
Protective Housing	X	X	X	X
Safety Interlock	X	X	X	X
Remote Connector			X	X
Key Control			X	X
Emission Indicator		X	X	X
Beam attenuator		X	X	X
Labels	I	II	III	IV
Certification and Manufacturer	X	X	X	X
Class Designation and Warning Logotype		X	X	X
Aperture Label		X	X	X
Radiation Output		X	X	X
Non-interlocked Protective Housing		X	X	X

10-3. Laser Protection Program.

A Laser Protection Program, as required for Commands where personnel may be exposed to class IIIa, class IIIb or class IV laser radiation should consist of the following elements:

a. A list of personnel responsibilities and qualifications,

b. A list of training requirements for operators and bystanders,

c. A description of the types and hazard potentials for the types of lasers used in the Command,

d. A description of laser safety measures used in the Command,

e. A compendium of Standing Operating Procedures for the lasers used within the Command,

f. An emergency response plan.

10-4. OSHA standards.

OSHA 29 CFR 1926.54 addresses worker exposure to non-ionizing radiation. OSHA requires that:

a. Only qualified and trained personnel work with laser equipment,

b. Proof of qualification shall be carried by the operator,

c. If the potential for exposure to direct or reflected laser light above the exposure limit exists, then workers will be furnished with acceptable eye protection,

d. Laser work areas must be properly posted,

e. Beam shutters and caps must be utilized,

f. Unattended lasers shall be shut off,

g. Only mechanical or electrical means will be used for beam alignment; beam alignment will not be made by eye.

h. The beam shall not be directed at employees,

i. Lasers shall not be used in the rain or in foggy conditions if possible,

j. Each laser shall be labeled to indicate its maximum output,

k. Lasers shall be used above the heads of personnel when possible; and

l. Employees shall not be exposed to light intensities above the exposure limits.

10-5. USACE Standards.

The Army and USACE have adopted the current American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) as the limits for employee exposure to lasers. The ACGIH TLVs are essentially the same as the ANSI Z136.1 standards. TLVs are dependent upon the wavelength of the light and the duration of exposure. Consult with the Command Laser Protection Officer to determine the TLV for each laser used within the Command.

10-6. Protective eyewear.

Protective goggles may be required when using some lasers. The protection factor of goggles depends on the wavelength of the laser light

and the amount of energy the laser can deposit at the site of exposure. The exact optical density required for any specific laser use scenario may be calculated using equations in ANSI Z136.1, or Table 10-2 may be used. Goggles must have a label listing the laser wavelengths for which they provide protection, their optical density at those wavelengths, and the amount of visible light that the goggles transmit. The LSO should verify the optical density calculation.

Table 10-2
Optical Density Requirements

Intensity, Continuous Wave Max. Power Density (watts/cm^2)	Optical Density	Attenuation Factor
0.01	5	10,000
0.1	6	100,000
1.0	7	1,000,000
10.0	8	10,000,000